AN AJSS An Asian Journal of Soil Science
Volume 11 | Issue 1 | June, 2016 | 235-237 | e ISSN–0976–7231 ■ Visit us : www.researchjournal.co.in

Research Article

DOI : 10.15740/HAS/AJSS/11.1/235-237

Effect of different composting cultures on physio-chemical and biological properties of compost prepared by using different crop wastes

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Received : 30.12.2015; **Revised :** 28.04.2016; **Accepted :** 24.05.2016

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Summary

Field experiment was conducted at College of Agriculture, Dhule to test the effect of EM and decomposing culture on decomposition of different crop wastes *viz*., soybean straw, weed (*Parthenium*), banana plant waste material, sunflower waste, sugarcane trash, cotton stalk and bajra stubble. Composting materials were analysed at 90 days for various physical,chemical and biological parameters by adopting standard procedures. Soybean straw decomposed at earliest with significantly maximum moisture content, highest weight loss and containing highest amount of nitrogen, humic acid, fulvic acid, CO_2 evolution rates and microbial population. Among the cultures used EM culture shown superiority over decomposing culture.

Key words : : Compost, Microbial culture, Crop residue

How to cite this article : Nazirkar, R.B. and Tambe, S.T. (2016). Effect of different composting cultures on physio-chemical and biological properties of compost prepared by using different crop wastes. *Asian J. Soil Sci.*, **11** (1) : 235-237 : **DOI : 10.15740/HAS/AJSS/11.1/235-237.**

Introduction

India has vast manurial resources such as animal waste, crop residue, green manure and agro industrial wastes. It is estimated that 388 million tones of crop residues are available in India which can add 7.3 million tones of major nutrient (N, P and K) and considerable amount of micronutrient (Beri *et al*., 1996). However, the main constraints for their use as compost are the large quantity of these residues used as animal feed, fuel in villages and burnt in the field. On the other hand decomposition is a biological process in which the micro organisms decomposing different crop residues under optimum temperature and moisture which reduces the C/N ratio. On an average 3-8 months are required for preparing good quality compost. Therefore, emphasis is given on decomposition of these crop residues by using different cultures like EM and decomposition culture. Applications of effective micro-organism and decomposition cultures in the composting pit to enhance the composting process and its quality enrichment as well. Hence, the present investigation was undertaken to study the decomposition of crop wastes using different cultures.

Resource and Research Methods

The experiment was laid out in Factorial Randomized Block Design (FRBD) consisted of 21 treatment combinations. Different sources (Factor A) of the decomposing material (Substrate) *viz*., A_1- Soybean straw, A_2- Sunflower waste, A_3- Cotton stalk, A_4- Bajra stubble, A_5- Sugarcane trash, A_6- Banana plant waste

material and A_7- Weed (*Parthenium*), these wastes were decomposed by cultures (Factor B) like B_1- Effective micro-organism (EM) culture, B_2- Decomposing culture (DC) and B_3- No culture (NC) in the pit (1x1 m) with two replications. The composting was done during summer of 2011-2012 at Soil Science and Agricultural Chemistry Section, College of Agriculture, Dhule. The compost samples were analyzed at 90 days for total organic carbon, C:N ratio, total N, P, K, humic acid, fulvic acid, CO_2 evolution, moisture, colour, weight loss, microbial counts by using standard methods.

Research Findings and Discussion

Soybean straw, weed (*Parthenium*), banana plant waste material, sunflower waste, sugarcane trash decomposed faster upto 90 days within the treatments in which EM culture was used, while DC cultures and NC used treatments slow to decompose the crop wastes (Table 1).

Composts prepared from different crop wastes showed neutral in reaction and medium salt content. Significantly highest pH (6.18) recorded in sunflower waste while highest EC (1.67 dSm^{-1}) was recorded in cotton stalk. EM culture recorded significantly highest pH (6.35) with lower EC (0.96 dSm^{-1}). Soybean straw recorded significantly lowest total organic carbon (11.80 %) which was at par with weed (*Parthenium*) (11.82). Cotton stalk recorded significantly higher TOC (18.48 %). NC shown significantly higher TOC (15.43 %). Highest total N (2.31), humic acid (5.07 g. 100 g^{-1}) and fulvic acid (15.27 g. 100 g^{-1}) content were recorded in the soybean straw, along with lowest E_4/E_6 ratio of HA (1.61) and FA (3.28), while maximum P (1.52 g.100 g^{-1}) and K (1.53 g.100 g^{-1}) content was recorded in weed (*Parthenium*) waste (Table 1 and 2). EM culture recorded significantly highest total N, P, K, HA and FA content *i.e.* 1.40, 0.706, 0.938, 2.66 (g 100 g^{-1}) and 14.66 (g 100 g^{-1}), respectively along with lowest E_4/E_6 ratio of HA (1.51) and FA (3.62). Among the all residues soybean straw waste and weed (*Parthenium*) were found to be good source of N, P and K nutrients. Significantly maximum cumulative CO_2 evolution recorded under soybean straw (1870.06 mg.10 g^{-1}) along with lowest C:N ratio (9.97) followed by weed (*Parthenium*) (1738.18 and 13.67 mg 10 g^{-1}n, respectively). EM culture treated

Table 1: Effect of crop wastes and composting cultures on physical and chemical properties of compost

Treatments	Moisture (%)	Weight loss (%)	pH	EC (dSm^{-1})	TOC (%)	N (%)	P (%)	K (%)
Crop residues								
A_1 Soybean straw	26.00	19.71	6.11	0.67	11.80	2.31	0.386	0.505
A_2 Sunflower waste	23.81	15.21	6.18	1.23	18.13	0.73	0.208	0.449
A_3 Cotton stalk	23.68	14.55	5.85	1.67	18.48	0.81	0.232	0.990
A_4 Bajara stubbles	24.78	15.71	6.00	1.30	18.16	0.79	1.126	1.071
A_5 Sugarcane trash	25.78	15.81	6.05	1.36	12.28	0.73	0.272	0.765
A_6 Banana plant residue	25.28	16.60	5.95	1.23	11.81	1.56	0.777	0.910
A_7 Weed (*Parthenium*)	24.45	16.21	6.06	0.69	11.82	1.91	1.527	1.536
S.E.±	0.27	0.47	0.056	0.069	0.30	0.040	0.019	0.020
C.D. (P=0.05)	0.82	1.40	0.167	0.204	0.91	0.120	0.057	0.061
Cultures used								
B_1 EM culture	25.35	18.83	6.35	0.96	13.83	1.40	0.706	0.938
B_2 DC culture	24.69	17.66	6.00	1.16	14.67	1.27	0.658	0.880
B_3 No culture	24.44	12.28	5.73	1.37	15.43	1.13	0.576	0.850
S.E.±	0.18	0.31	0.037	0.045	0.20	0.026	0.012	0.013
C.D. (P=0.05)	0.53	0.91	0.110	0.133	0.59	0.078	0.037	0.040
Interaction AxB								
S.E.±	0.48	0.82	0.098	0.119	0.53	0.070	0.03	0.036
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
General mean	24.82	16.26	6.03	1.16	14.64	1.27	0.646	0.889

NS= Non-significant

Table 2: Effect of crop wastes and composting cultures on chemical and biological properties of compost

Treatments	CO_2 (mg 10 g^{-1})	HA (g 10 g^{-1})	FA (g 10 g^{-1})	C:N ratio	E4/E6 ratio FA	E4/E6 ratio HA	Microbial count		
							Bacteria (10^6xCFU g^{-1})	Fungi (10^6xCFU g^{-1})	Actinomycetes (10^6xCFU g^{-1})
Crop residues									
A_1 Soybean straw	1870.06	5.07	15.27	9.97	3.28	1.61	12.58	9.18	7.86
A_2 Sunflower waste	1342.33	1.03	13.39	29.55	3.42	1.73	9.50	7.48	6.51
A_3 Cotton stalk	1492.81	0.95	12.86	32.19	5.96	3.15	8.98	5.58	5.23
A_4 Bajara stubble	1419.10	1.00	12.48	27.71	5.85	2.54	10.23	7.55	7.16
A_5 Sugarcane trash	1240.36	2.16	13.70	18.81	4.27	1.67	9.20	6.71	6.21
A_6 Banana plant residue	1675.21	2.86	14.16	16.2	4.27	1.84	10.38	7.95	7.61
A_7 Weed (*Parthenium*)	1738.18	3.56	14.40	13.67	3.69	1.92	10.76	8.00	7.76
S.E.±	19.09	0.141	0.501	0.842	0.188	0.143	0.468	0.239	0.248
C.D. (P=0.05)	56.34	0.416	1.479	2.48	0.557	0.422	0.821	0.705	0.732
Cultures used									
B_1 EM culture	1634.75	2.66	14.66	20.27	3.62	1.51	12.81	8.67	8.33
B_2 DC culture	1532.02	2.45	13.79	21.01	4.15	1.97	10.17	7.42	6.72
B_3 No culture	1452.39	2.01	12.81	22.41	5.41	2.72	7.72	6.38	5.67
S.E.±	12.50	0.092	0.328	0.551	0.123	0.093	0.306	0.156	0.162
C.D. (P=0.05)	36.88	0.272	0.968	1.62	0.364	0.276	0.531	0.462	0.479
Interaction AxB									
S.E.±	33.08	0.244	0.868	1.45	0.327	0.248	0.811	0.414	0.430
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS			NS
General mean	1539.72	2.37	13.75	21.23	4.39	2.07	10.23	7.49	6.91

NS= Non-significant

composting material showed significantly higher CO_2 evolution (1634.75 mg 10 g^{-1}) along with lowest C:N ratio (20.27). Similar trends of compost testing parameters were observed by Singh *et al*. (1995) and Maheswari (2002).

Significantly higher microbial count of bacteria (12.58 x 10^6 CFU g^{-1}), fungi (9.18 x 10^4 CFU g^{-1}) and actinomycetes (7.86 x 10^3 CFU g^{-1}) recorded in soybean straw compost, while lowest microbial count of bacteria (8.98 x 10^6 CFU g^{-1}), fungi (5.58 x 10^4 CFU g^{-1}) and actinomycetes (5.23 x 10^3 CFU g^{-1}) recorded in cotton stalk. EM culture treatments recorded highest microbial population bacteria (12.81 x 10^6 CFU g^{-1}), fungi (8.67 x 10^4 CFU g^{-1}) and actinomycetes (8.33 x 10^3 CFU g^{-1}). Similar trend of observations were recorded biological count by Battikopad *et al*. (2009).

From the present findings it can be concluded that compost prepared from soybean straw matures earlier than rest of the residues and found better to get quality compost. In respect of cultures, EM culture produced good quality compost in respect of major nutrients, humic acid, fulvic acid, organic carbon and microbial count.

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